

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

In the Matter of	)	
	)	
Amendment of Part 15 of the Commission's Rules	)	ET Docket No. 14-165
for Unlicensed Operations in the Television Bands,	)	
Repurposed 600 MHz Band, 600 MHz Guard	)	
Bands and Duplex Gap, and channel 37, and	)	
	)	
Amendment of Part 74 of the Commission's Rules	)	
for Low Power Auxiliary Stations in the	)	
Repurposed 600 MHz Band and 600 MHz Duplex	)	
Gap	)	
	)	
Expanding the Economic and Innovation	)	GN Docket No. 12-268
Opportunities of Spectrum Through Incentive	)	
Auctions	)	

**COMMENTS OF WI-FI ALLIANCE**

Russell H. Fox  
Kara D. Romagnino

MINTZ, LEVIN, COHN, FERRIS, GLOVSKY  
AND POPEO, PC  
701 Pennsylvania Ave., NW  
Suite 900  
Washington, DC 20004  
(202) 434-7300

*Counsel for Wi-Fi Alliance*

Edgar Figueroa  
President and CEO

WI-FI ALLIANCE  
10900-B Stonelake Blvd.  
Suite 126  
Austin, TX 78759  
(512) 498-9434  
[efigueroa@wi-fi.org](mailto:efigueroa@wi-fi.org)

February 4, 2015

## SUMMARY

This proceeding is an important step to growing the capacity of unlicensed communications systems, which are an increasingly important part of the mobile broadband ecosystem. Unlicensed devices support business and consumer Internet access and provide offload capabilities for licensed wireless networks, and they will drive the development of the Internet of Things. Wi-Fi Alliance applauds the Commission's efforts to make additional spectrum available for these and other applications at 600 MHz.

In particular, Wi-Fi Alliance supports the Commission's proposals to expand the television channels available for fixed and personal/portable white space devices and permit operations in the 600 MHz guard bands and duplex gap, on channel 37, and in the repurposed 600 MHz band. The Commission should also adopt technical rules governing these operations that will promote the most effective use of the spectrum by unlicensed devices, including by increasing antenna heights and power limits for fixed devices in rural areas; updating the channel bonding rules and adjacent-channel restrictions; permitting devices with less location accuracy to operate where such operations can occur without compromising protection of licensed and incumbent operations; and removing the additional out-of-band emissions requirements for channels 36-38. The Commission should also require wireless microphones operating in the TV Bands, guard bands, duplex gap, and repurposed 600 MHz band to communicate with a database, consistent with the requirement for all white space devices.

In addition to providing consistency in its rules, the Commission should take steps to improve its regulations governing spectrum databases in order to promote more efficient use of the newly available spectrum. Specifically, the Commission should require white space device antenna patterns to be included in the database. By requiring this additional information, the database will be able to affirmatively assign a channel and other technical parameters to the

white space device for a certain period of time based on the device's operating parameters and the spectrum landscape in which the device proposes to operate. This, in turn, will eliminate the need for a distinction between fixed and portable devices and for database rechecking during the time the use of a channel is authorized. By requiring additional information to be added to the database, the Commission can also increase the ability of database administrators to maximize the times and locations in which unlicensed devices may operate, all while continuing to protect co- and adjacent-channel licensed and incumbent operations.

Wi-Fi Alliance appreciates the Commission's actions in this proceeding and encourages it to adopt rules that will maximize the spectrum available to and usable by unlicensed devices. Adopting its proposals as modified here will help ensure that a platform exists to further promote the innovations in unlicensed technologies, which have proven valuable to the American economy, businesses, and consumers.

## TABLE OF CONTENTS

<b>I.</b>	<b>BACKGROUND AND INTRODUCTION.....</b>	<b>2</b>
<b>II.</b>	<b>FIXED AND PORTABLE WHITE SPACE DEVICES .....</b>	<b>5</b>
A.	Television Bands.....	6
1.	White space devices should be permitted to operate on the first two vacant channels above and below channel 37.....	7
2.	Fixed white space devices should be permitted to operate on channels 3 and 4.....	8
3.	Personal/portable devices should be permitted to operate on channels 14-20. ....	9
4.	Personal/portable devices should be permitted to operate on channels 7-13. ....	11
5.	The Commission should generally adopt its technical proposals for fixed devices. ....	13
6.	Antenna heights and power limits for fixed devices in rural areas should be increased. ....	15
7.	The Commission should generally adopt the proposed power limits for personal/portable devices in rural areas. ....	16
8.	The channel bonding and channel aggregation rules should be amended. ....	18
9.	The proposed propagation model for determining separation distances from television station contours is not appropriate. ....	20
10.	The Commission should generally adopt its proposals regarding location accuracy. ....	23
B.	600 MHz Guard Bands .....	24
C.	600 MHz Duplex Gap.....	25
1.	The Commission should divide the duplex gap.....	25
2.	Fixed and personal/portable devices should be permitted to operate with a power level of 40 milliwatts.....	26
3.	A one-megahertz gap between white space devices and LTE uplink is appropriate.....	26
D.	Channel 37 .....	27
1.	Fixed and Modes I and II personal/portable devices should be permitted on channel 37.....	28
2.	The Commission should generally adopt the proposed maximum proposed power limits and technical requirements for operations on channel 37. ....	29

3.	The Commission should adopt a different methodology for calculating WMTS and Very Long Baseline Array (“VLBA”) separation distances. ....	30
4.	Three-megahertz guard bands around channel 37 should be available for unlicensed operations.....	32
5.	The additional out-of-band emissions requirements for channels 36-38 should be removed.....	33
E.	Repurposed 600 MHz Band.....	34
<b>III.</b>	<b>WIRELESS MICROPHONES</b> .....	35
A.	Unlicensed Wireless Microphones in the TV Bands .....	35
1.	Unlicensed wireless microphones should comply with the Part 74 technical standards. ....	35
2.	Unlicensed wireless microphones should comply with the ETSI emission mask standard. ....	37
B.	Wireless Microphones in the 600 MHz Guard Bands and Duplex Gap .....	38
C.	Wireless Microphones in the Repurposed 600 MHz Band.....	39
<b>IV.</b>	<b>WHITE SPACE DATABASES</b> .....	40
A.	Dialogue with Database .....	40
B.	Protection of Wireless Medical Telemetry Service .....	43
C.	Unlicensed Wireless Microphone Registration .....	44
<b>V.</b>	<b>CONCLUSION</b> .....	45

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

In the Matter of	)	
	)	
Amendment of Part 15 of the Commission’s Rules	)	ET Docket No. 14-165
for Unlicensed Operations in the Television Bands,	)	
Repurposed 600 MHz Band, 600 MHz Guard	)	
Bands and Duplex Gap, and channel 37, and	)	
	)	
Amendment of Part 74 of the Commission’s Rules	)	
for Low Power Auxiliary Stations in the	)	
Repurposed 600 MHz Band and 600 MHz Duplex	)	
Gap	)	
	)	
Expanding the Economic and Innovation	)	GN Docket No. 12-268
Opportunities of Spectrum Through Incentive	)	
Auctions	)	

**COMMENTS OF WI-FI ALLIANCE**

Wi-Fi Alliance submits these comments in response to the Notice of Proposed Rulemaking (“NPRM”) issued by the Commission seeking comment on proposed rules for the operation of unlicensed devices in spectrum generally used for broadcast television service (“TV Bands”), some of which will become available for licensed wireless operations in the future.<sup>1/</sup>

Wi-Fi Alliance applauds the Commission for its efforts to create additional opportunities for unlicensed devices to be deployed in that spectrum and urges it to adopt technical rules that will encourage innovation and promote the best and most efficient use of the Nation’s spectrum resources.

---

<sup>1/</sup> See *Amendment of Part 15 of the Commission’s Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and channel 37, and Amendment of Part 74 of the Commission’s Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 29 FCC Rcd. 12248 (2014) (“NPRM”).

## I. BACKGROUND AND INTRODUCTION

Wi-Fi Alliance is a global, non-profit industry association of approximately 600 leading companies from dozens of countries devoted to seamless interoperability. With technology development, market building, and regulatory programs, Wi-Fi Alliance has enabled widespread adoption of Wi-Fi worldwide, certifying thousands of Wi-Fi products each year. The mission of Wi-Fi Alliance is to provide a highly effective collaboration forum for Wi-Fi matters, grow the Wi-Fi industry, lead industry growth with new technology specifications and programs, support industry-agreed standards, and deliver greater product connectivity through interoperability, testing, and certification.

Since its inception in 1999, Wi-Fi has seen continued advancements, with today's most advanced Wi-Fi devices delivering as much as one gigabit per second of data rate when communicating with other current-generation technologies.<sup>2/</sup> With these technological achievements has come increased adoption: about two billion Wi-Fi devices were sold in 2013 alone and more than four billion are expected to be sold in 2020.<sup>3/</sup> Today, Wi-Fi hotspots number more than five million worldwide and are expected to reach 10 million by 2018, while more than 725 million households around the world are expected to have a Wi-Fi connection this year.<sup>4/</sup> This ubiquity of Wi-Fi connectivity has spurred substantial benefits for the economy, with the combined value of future proliferation of current Wi-Fi technologies amounting to more

---

<sup>2/</sup> Wi-Fi Alliance, Discover Wi-Fi, 15 Years of Wi-Fi, <http://www.wi-fi.org/discover-wi-fi/15-years-of-wi-fi> (last visited Feb. 3, 2015).

<sup>3/</sup> Wi-Fi Alliance News Release, *Wi-Fi Alliance® Celebrates 15 Years of Wi-Fi®* (Sept. 8, 2014), <http://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-celebrates-15-years-of-wi-fi>.

<sup>4/</sup> See Wi-Fi Alliance, *Wi-Fi Alliance, Connect Your Life: Wi-Fi and the Internet of Everything*, at 4 (Jan. 2014), available at [http://www.wi-fi.org/system/files/wp\\_Wi-Fi\\_Internet\\_of\\_Things\\_Vision\\_20140110.pdf](http://www.wi-fi.org/system/files/wp_Wi-Fi_Internet_of_Things_Vision_20140110.pdf); see also ABI Research News Release, *Global Wi-Fi Hotspots Will Grow to 7.1 Million in 2015 as a Method to Offload Traffic* (May 8, 2014), <https://www.abiresearch.com/press/global-wi-fi-hotspots-will-grow-to-71-million-in-2>.

than \$547 billion in economic value and nearly \$50 billion in contribution to the gross domestic product.<sup>5/</sup>

Unlicensed spectrum is also a valuable complement to licensed wireless services. Consumers increasingly rely on Wi-Fi technologies to access the Internet on their mobile devices, with Wi-Fi embedded in 99 percent of all smartphones today.<sup>6/</sup> Moreover, licensed providers have begun using Wi-Fi offloading at exponential rates, which allows them to deliver higher quality service to consumers.<sup>7/</sup> Wi-Fi is a particularly attractive means of offloading large amounts of mobile data traffic since it is cost effective, widely available, and easily integrated into mobile core networks.<sup>8/</sup> Additionally, Wi-Fi calling has also been marketed by major cellular carriers as a way for consumers to call and text virtually anywhere.<sup>9/</sup>

In order to continue to realize these benefits, additional spectrum must be made accessible to and usable by unlicensed devices. The Commission has taken numerous important steps over the last two years to expand the spectrum resources available for unlicensed

---

<sup>5/</sup> See Telecom Advisory Services, LLC, *Assessment of the Future Economic Value of Unlicensed Spectrum in the United States*, at 9 (Aug. 2014), available at <http://www.wififorward.org/wp-content/uploads/2014/01/Katz-Future-Value-Unlicensed-Spectrum-final-version-1.pdf> (“WifiForward Unlicensed Spectrum Study”).

<sup>6/</sup> See *Carrier Wi-Fi and Mobile Offload*, ABI Research (2012), available at <https://www.abiresearch.com/market-research/product/1009515-carrier-wi-fi-and-mobile-offload/>; see also *Terrestrial Use of the 2473-2495 MHz Band for Low-Power Mobile Broadband Networks; Amendments to Rules for the Ancillary Terrestrial Component of Mobile Satellite Service System*, Notice of Proposed Rulemaking, 28 FCC Rcd. 15351, ¶ 13 (2013).

<sup>7/</sup> WifiForward Unlicensed Spectrum Study at 9.

<sup>8/</sup> *Architecture for Mobile Data Offload Over Wi-Fi Access Networks*, Cisco (2012), available at [http://www.cisco.com/c/en/us/solutions/collateral/service-provider/service-provider-wi-fi/white\\_paper\\_c11-701018.pdf](http://www.cisco.com/c/en/us/solutions/collateral/service-provider/service-provider-wi-fi/white_paper_c11-701018.pdf).

<sup>9/</sup> See T-Mobile, Wi-Fi Calling, <http://www.t-mobile.com/offer/wifi-calling-wifi-extenders.html> (last visited Feb. 3, 2015); see also Sprint, FAQs About Sprint Wi-Fi Calling, [http://support.sprint.com/support/article/FAQs\\_about\\_Sprint\\_WiFi\\_calling/173e331f-8423-453e-93cb-4688f6a91f67](http://support.sprint.com/support/article/FAQs_about_Sprint_WiFi_calling/173e331f-8423-453e-93cb-4688f6a91f67) (last visited Feb. 3, 2015); Phil Goldstein, *Verizon Wireless Plans to Launch Wi-Fi Calling in Mid-2015*, FIERCEWIRELESS (Sept. 17, 2014), <http://www.fiercewireless.com/story/verizon-wireless-plans-launch-wi-fi-calling-mid-2015/2014-09-17>; Roger Cheng, *AT&T Plans to Offer Wi-Fi Calling in 2015*, CNET (Sept. 12, 2014), <http://www.cnet.com/news/at-t-plans-to-offer-wi-fi-calling-in-2015/>.



operations, including opening up portions of the 5 GHz band for unlicensed devices to operate on a shared basis<sup>10/</sup> and exploring the application of small cell technologies in the 3.5 GHz band.<sup>11/</sup>

This proceeding offers a valuable opportunity to continue those efforts.

Wi-Fi Alliance therefore urges the Commission to expand the television channels available for fixed and personal/portable Television White Spaces (“white space”) devices – including channels 3 and 4, 7-13, 14-20, and the first two vacant channels above and below channel 37 – and develop technical rules to permit fixed, Mode I, and Mode II devices to operate in the 600 MHz guard bands and duplex gap, on channel 37, and in the repurposed 600 MHz band. The Commission should also adopt technical rules that will maximize the use of unlicensed devices in the TV Band, including increasing the power for personal/portable devices in rural areas, updating the channel bonding rules and adjacent-channel restrictions, and permitting devices with less location accuracy to operate where such operations can occur without compromising protection of licensed and incumbent operations. In calculating separation distances between white space devices and other operations, the Commission should refrain from using the TM 91-1 propagation model. The Commission should also take steps to facilitate the operation of wireless microphones in the TV Bands, guard bands, duplex gap, and repurposed 600 MHz band, including by imposing a database requirement on such operations that is similar to other white space devices.

---

<sup>10/</sup> See *Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, First Report and Order, 29 FCC Rcd. 4127 (2014); *Revision of Part 15 of the Commission’s Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band*, Notice of Proposed Rulemaking, 28 FCC Rcd. 1769 (2013) (“5 GHz NPRM”). The 5 GHz band is ideal for additional Wi-Fi growth because it is adjacent to existing Wi-Fi spectrum, which allows for the creation of larger contiguous spectrum blocks. These larger blocks of spectrum can enable the use of the latest Wi-Fi technologies, including the IEEE 802.11ac Wi-Fi standard, which will foster support for streaming video and other higher bandwidth requirements.

<sup>11/</sup> See *Amendment of the Commission’s Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Further Notice of Proposed Rulemaking, 29 FCC Rcd. 4273 (2014).

The Commission committed in this proceeding to improving the white space databases, a goal that Wi-Fi Alliance enthusiastically supports. The FCC should therefore require additional information to be added to the database – including more information about white space device antenna patterns and more precise information about the location of Wireless Medical Telemetry Service (“WMTS”) operations – which will serve to increase the locations at which unlicensed devices can operate without causing harmful interference to other services. The more information that is available in the database, the greater the ability of the database administrator to permit white space operations in a wider area and at greater power levels without overprotecting incumbent operations. Moreover, the Commission should refocus its attention away from designating specific intervals during which white space devices must re-check the database and toward a more interactive database methodology that relies on the assignment of appropriate power limits and channels for a designated period of time, and monitors white space use of channels in order to capture more information about channel use. With these changes, the Commission will facilitate its goal of making white space database management more timely and efficient for all interested stakeholders.

## **II. FIXED AND PORTABLE WHITE SPACE DEVICES**

In the *Incentive Auction Report and Order*, the Commission determined that unlicensed operations would be permitted in the TV Bands, in the 600 MHz guard bands (including the duplex gap), in the portion of spectrum assigned to new Part 27 licensees where such wireless licensees have not yet commenced operations, and on channel 37.<sup>12/</sup> The NPRM is designed to develop the technical rules for these unlicensed operations. As explained in more detail below,

---

<sup>12/</sup> NPRM ¶10; *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Report and Order, 29 FCC Rcd. 6567, ¶¶ 265-268 (2014) (“*Incentive Auction Report and Order*”). All told, between 20 and 34 megahertz of spectrum will be newly available for unlicensed use. *Incentive Auction Report and Order* ¶ 264.

Wi-Fi Alliance encourages the Commission to adopt technical rules for unlicensed operations that will foster the most effective and efficient use of these newly expanded allocations.

### **A. Television Bands**

The Commission currently permits unlicensed devices to operate in the TV Bands in locations where spectrum is not in use by licensed services.<sup>13/</sup> White space devices may be either fixed or personal/portable and must obtain a list of available TV channels that may be used at a specific location.<sup>14/</sup> While fixed devices may operate on any available television channel within its range, personal/portable operations are limited to channels 21-51 (excluding channel 37).<sup>15/</sup> In the *Incentive Auction Report and Order*, the Commission decided that white space devices may continue to operate under Part 15 rules in the spectrum that remains allocated and assigned to TV broadcast services following the incentive auction.<sup>16/</sup> Wi-Fi Alliance supports this determination and urges the FCC to adopt the proposed technical rules with modifications as suggested below.

---

<sup>13/</sup> See 47 C.F.R. § 15.701 *et seq*; NPRM ¶¶ 5, 14. White space devices are not permitted to operate on channel 37 (608-614 MHz) or on any channel within 2.4 kilometers of protected radio observatories. 47 C.F.R. § 15.712; NPRM ¶ 5.

<sup>14/</sup> See 47 C.F.R. § 15.703; NPRM ¶¶ 5, 20. Fixed devices must incorporate a geo-location capability and a means of accessing a database that provides a list of TV channels available for operation. Portable devices can operate as either Mode I or Mode II devices: Mode II devices must incorporate geo-location and database access capabilities similar to fixed devices, while Mode I devices are not required to incorporate such capabilities, but instead must obtain a list of available channels from either a fixed or Mode II device. NPRM ¶ 20; 47 C.F.R. 15.703(c), (e), (f).

<sup>15/</sup> NPRM ¶ 22; 47 C.F.R. § 15.703(c), (i).

<sup>16/</sup> *Incentive Auction Report and Order* ¶¶ 265, 269. The Commission expects that there will be at least one channel not assigned to a television station in all areas of the country following the incentive auction repacking process, but it postpones for a later proceeding any changes to the white space rules relating to this future preserved channel. NPRM ¶ 26; *Incentive Auction Report and Order* ¶¶ 265, 269.

**1. White space devices should be permitted to operate on the first two vacant channels above and below channel 37.**

The FCC proposes to eliminate the current prohibition on white space device use on the first two vacant channels above and below channel 37.<sup>17/</sup> As the Commission explains, this prohibition was designed to ensure that spectrum was available for wireless microphone operations.<sup>18/</sup> However, in the *Incentive Auction Report and Order*, the Commission determined that it was no longer necessary to designate up to two unused television channels in any area exclusively for wireless microphone operations because it took various steps to expand and promote wireless microphone operations. Among other things, the Commission revised its rules by reducing the current co-channel separation distances applicable to wireless microphone operations in the TV Bands (thus expanding the areas where wireless microphones may be used); extended to certain unlicensed wireless microphone users the rights of licensed wireless microphone users to access television spectrum; and determined to designate one television channel in each area for shared use by wireless microphones and unlicensed devices.<sup>19/</sup> The Commission therefore proposes to make the channels previously exclusively designated for use by wireless microphones available for use by white space devices.<sup>20/</sup>

Wi-Fi Alliance supports the expansion of channels available for white space device operations to the first two vacant channels above and below channel 37. Because these channels will no longer be used exclusively for wireless microphone operations, it is appropriate to apply the general white space rules to those channels. Moreover, the proposed rules governing

---

<sup>17/</sup> NPRM ¶ 25.

<sup>18/</sup> *Id.* ¶ 24.

<sup>19/</sup> *Id.*; *Incentive Auction Report and Order* ¶¶ 304-310, 685.

<sup>20/</sup> NPRM ¶ 25.

operation based on database authorization will protect any continued operations on those channels, whether by wireless microphones, television stations, or licensed wireless services.

**2. Fixed white space devices should be permitted to operate on channels 3 and 4.**

The Commission also proposes to eliminate the prohibition on fixed white space device operations on channels 3 and 4, which will provide an additional 12 megahertz of contiguous spectrum for use by white space devices in areas where those channels are not used for other authorized services.<sup>21/</sup> The prohibition was originally designed to prevent interference to television interface devices with signal outputs on channels 3 or 4 – *e.g.*, VCRs, DVRs, and cable and satellite converter boxes.<sup>22/</sup> However, even while prohibiting white space devices from operating on these channels, the Commission recognized that “there was not a significant amount of other new empirical information on the record on the susceptibility of TV interface devices or TV receivers.”<sup>23/</sup>

The FCC therefore now proposes to act on its earlier recognition, correctly noting that the current prohibition on fixed white space device operations on channels 3 and 4 “may no longer be warranted.”<sup>24/</sup> As the Commission observes, the prohibition was based on the use of these channels by analog television devices, the use of which has rapidly declined since the transition

---

<sup>21/</sup> NPRM ¶¶ 27-28.

<sup>22/</sup> *Id.* ¶¶ 22, 27; see also *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Second Report and Order and Memorandum Opinion and Order, 23 FCC Rcd. 16807, ¶¶ 149-150 (2008) (“*White Spaces Second Report and Order*”) (finding that “emissions from an unlicensed TV band device on channels 3 or 4 could cause interference to the output of the TV interface device” and that “TV receivers themselves appear to be more susceptible to direct pick-up interference on channels 3 and 4”).

<sup>23/</sup> *White Spaces Second Report and Order* ¶ 149.

<sup>24/</sup> NPRM ¶ 27.

from analog to digital television in 2009.<sup>25/</sup> By the time this proceeding concludes and these channels are actually available for white space device operations, there will be even fewer of these devices in operation.<sup>26/</sup> To the extent that analog televisions continue to operate in the bands, interference can be controlled if consumers simply refrain from operating white space devices near devices that use channels 3 and 4. By opening up these channels for use by white space devices, the Commission will “maximize the opportunities for operation of unlicensed devices in all areas,” which will in turn encourage innovation on the part of device manufacturers to the ultimate benefit of consumers.<sup>27/</sup>

### **3. Personal/portable devices should be permitted to operate on channels 14-20.**

Operation of personal/portable devices on channels 14-20 is currently prohibited in order to protect Private Land Mobile Radio Service (“PLMRS”) and Commercial Mobile Radio Service (“CMRS”) operations on those channels in certain cities.<sup>28/</sup> In adopting the prohibition, the Commission found that identification of PLMRS and CMRS operations using spectrum sensing and other techniques can be difficult since these operations are intermittent in nature, and thus adopted a conservative approach to prohibit personal/portable devices from operating in *all* areas of the country on those channels (even where channels 14-20 are not reserved for

---

<sup>25/</sup> *Id.* (noting that the digital transition “spurred many consumers to replace their old analog TV receivers with digital receivers that have multiple inputs that allow the connection of external devices without requiring the use of a channel 3 or 4 input signal”).

<sup>26/</sup> *Id.* (“While we recognize that some consumers continue to use older analog TV sets with a converter box or other TV interface devices with a channel 3 or 4 output, we believe that number is significantly less than in 2008, and will continue to drop over time as older TV sets are replaced.”).

<sup>27/</sup> *White Spaces Second Report and Order* ¶ 148 (stating that “it is important that TV band devices be allowed to operate on the largest practicable number of television channels”).

<sup>28/</sup> NPRM ¶ 22.

PLMRS/CMRS use).<sup>29/</sup> The Commission later affirmed this determination, stating that, while geo-location and database rules will provide a high degree of assurance that PLMRS/CMRS and other services will be protected, “the nomadic nature and expected higher numbers of personal/portable devices poses some potential for interference to those services.”<sup>30/</sup>

Nevertheless, in the intervening six years, the Commission has developed “extensive experience” working with the TV Bands databases and now believes with “a high degree of confidence that the databases can reliably protect PLMRS/CMRS operations.”<sup>31/</sup> Wi-Fi Alliance agrees and encourages the Commission to proceed with its proposal to remove the prohibition on personal/portable device operation on channels 14-20.<sup>32/</sup> The existing database access rules, as modified in this proceeding, will be able to protect incumbent operations from personal/portable device operations in the same way that fixed devices now protect that spectrum. As the Commission recognizes, the locations where the PLMRS and CMRS is used are already in the TV bands databases since that information is used to protect those operations from fixed white space device operations. Personal/portable devices would be able to similarly protect such operations since they would also rely on database access rather than the spectrum sensing previously envisioned.<sup>33/</sup> In fact, because personal/portable devices must be associated with fixed or Mode II devices which themselves are required to operate only when authorized by the white space database, there is little reason to establish separate rules for personal/portable device

---

<sup>29/</sup> See *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, First Report and Order and Further Notice of Proposed Rulemaking, 21 FCC Rcd. 12266, ¶ 21 (2006).

<sup>30/</sup> *White Spaces Second Report and Order* ¶ 152.

<sup>31/</sup> NPRM ¶ 30.

<sup>32/</sup> *Id.* ¶ 31.

<sup>33/</sup> *Id.* ¶ 30.

use of particular channels. Accordingly, there is no reason to believe that PLMRS/CMRS operations cannot be protected in the same way as other incumbent licensees.

Additionally, the Commission's previous concerns about public safety entities operating in that spectrum will shortly become moot. The Spectrum Act requires public safety entities to be relocated from channels 14-20 within nine years of enactment of the statute and for that spectrum to be auctioned in order to grant new initial licenses for the use of the bands.<sup>34/</sup> Moreover, many public safety systems will be migrating to commercial services and the newly implemented 700 MHz public safety broadband network.<sup>35/</sup> The Commission should therefore remove the prohibition against personal/portable devices on channels 14-20, which would make an additional 42 megahertz of spectrum potentially available for unlicensed operations in locations where the spectrum is not otherwise used by PLMRS, CMRS, or other authorized services.<sup>36/</sup>

#### **4. Personal/portable devices should be permitted to operate on channels 7-13.**

The Commission further seeks comment on whether to permit personal/portable devices to operate below channel 14.<sup>37/</sup> When the Commission adopted its white space rules, it was not only concerned with protecting PLMRS/CMRS operations on channels 14-20 (as discussed above), but also with limiting the number of white space devices that could potentially conflict

---

<sup>34/</sup> See Middle Class Tax Relief and Job Creation Act of 2012 § 6102(a), 47 U.S.C. § 1413(a), Pub. L. No. 112-96, 126 Stat. 156 (2012) ("Spectrum Act").

<sup>35/</sup> See Spectrum Act §§ 6201-6202, 47 U.S.C. §§ 1421-1422 (providing that the FCC "shall reallocate and grant a license to the First Responder Network Authority [(“FirstNet”)] for the use of the 700 MHz D block spectrum and existing public safety broadband spectrum” and that FirstNet “shall ensure the establishment of a nationwide, interoperable public safety broadband network”).

<sup>36/</sup> NPRM ¶ 31.

<sup>37/</sup> *Id.* ¶ 32.



with wireless microphone use on channels 5-20.<sup>38/</sup> In seeking to protect wireless microphones, however, the Commission also recognized the competing interest of wireless Internet service providers (“WISPs”) and others using fixed white space devices to reach rural and underserved areas at distances that were not reachable with lower-power devices operating at higher frequencies.<sup>39/</sup> The FCC balanced these interests by permitting the use of fixed devices on channels 5-20 (where such devices could communicate with other fixed devices) but prohibiting the use of personal/portable devices on those channels.<sup>40/</sup> The FCC now asks whether the prohibition on personal/portable devices should be eliminated and, if so, on which channels personal/portable devices should be permitted to operate.<sup>41/</sup>

The Commission correctly proposes to open channels 7-13 for use by personal/portable white space devices, which will make an additional 42 megahertz of spectrum potentially available for unlicensed operations.<sup>42/</sup> At the core and as noted above, there is no structural reason for the Commission to permit only particular types of white space device operations on certain channels, whether on channels 2-4, 7-13, or 14-20. Instead, based on a device’s proposed operation, the database should relay appropriate power levels and the duration of permitted operations on particular channels for both fixed and personal/portable devices. In addition, Mode I personal/portable devices must receive instructions from either a fixed or Mode II device, both of which must access a white space database to, as Wi-Fi Alliance recommends, obtain an assignment from the database of the channel(s) and other parameters under which they

---

<sup>38/</sup> *White Spaces Second Report and Order* ¶ 151.

<sup>39/</sup> *Id.*

<sup>40/</sup> *Id.*

<sup>41/</sup> NPRM ¶ 32.

<sup>42/</sup> *Id.*

can operate.<sup>43/</sup> There is thus no need for different considerations for fixed and personal/portable devices on these channels.

## **5. The Commission should generally adopt its technical proposals for fixed devices.**

Fixed white space devices are currently permitted to operate at a maximum power of four watts equivalent isotropically radiated power (“EIRP”), but are not permitted to operate adjacent to occupied TV channels.<sup>44/</sup> Following the incentive auction, fewer vacant television channels will be available for white space device operations. As a result, the Commission expects that there will not be as many locations where three contiguous vacant channels exist, reducing the locations at which fixed devices could operate.<sup>45/</sup> It therefore proposes two changes to its rules to provide fixed devices access to additional vacant television channels. First, the Commission proposes to allow fixed devices to operate adjacent to occupied television channels – *i.e.*, within their service contour – at a reduced 40 milliwatt EIRP power limit and to modify its table of separation distances to reflect this change.<sup>46/</sup> Second, the Commission proposes to allow fixed devices to operate with a maximum of four watts EIRP at locations where there are two contiguous vacant television channels instead of three, which would allow fixed devices to

---

<sup>43/</sup> 47 C.F.R. § 15.703(c), (e), (f).

<sup>44/</sup> NPRM ¶¶ 33, 37. The prohibition on fixed white space device operations on the first adjacent channel to a television station effectively requires three contiguous vacant channels for fixed operations. *See White Spaces Second Report and Order* ¶ 170 (prohibiting unlicensed devices from operating co-channel to a TV station and prohibiting fixed devices from operating on a channel adjacent to a TV station); 47 C.F.R. § 15.703(c).

<sup>45/</sup> *Id.* ¶ 34.

<sup>46/</sup> *Id.* ¶¶ 35, 39-43. The Commission proposes to define separation distances for fixed devices at EIRP levels of 40, 100, 250, 625, 1600, and 4000 milliwatts as 16, 20, 24, 28, 32, and 36 dBm, respectively. *Id.* ¶ 40.

operate at the maximum power currently permitted but expand their potential areas of operation.<sup>47/</sup>

Wi-Fi Alliance agrees with these technical proposals. Personal/portable devices are already permitted to operate within the service contour of adjacent channel television stations at a reduced 40 milliwatt EIRP power level.<sup>48/</sup> By amending its rules to allow fixed devices to operate within the service contour of occupied television channels at the same power level, the Commission will provide uniformity for fixed and personal/portable operations. As noted above, there should be no meaningful difference in the ability of fixed and personal/portable devices to access white space spectrum – the database should be able to calculate the permissible parameters under which both can operate. The FCC should also permit fixed devices to operate at a maximum of four watts where two contiguous television channels are available. As the Commission recognizes, such operations will increase spectrum efficiency without increasing the potential of interference to television reception.<sup>49/</sup> Wi-Fi Alliance further agrees that the FCC can “provide even more flexibility for white space device users by defining intermediate power levels and corresponding separation distances.”<sup>50/</sup> However, while co- and adjacent-channel separation distances for fixed devices from the TV contour should be based on intermediate power levels in uniform 4 dB steps, the Commission should include 8 dBm and 12 dBm to the list of intermediate limits.

---

<sup>47/</sup> *Id.* ¶ 37.

<sup>48/</sup> *Id.* ¶ 33. Personal/portable white space devices are otherwise permitted to operate outside the service contour at a maximum power of 100 milliwatts EIRP. NPRM ¶ 33; 47 C.F.R. § 15.709(a)(2).

<sup>49/</sup> NPRM ¶ 37, n.59 (citing several studies testing the use of white space devices operating adjacent to television channels, which reported no instances of interference to broadcast reception).

<sup>50/</sup> *Id.* ¶ 40.

**6. Antenna heights and power limits for fixed devices in rural areas should be increased.**

The Commission proposes a number of changes to provide white space device operators more flexibility in rural areas.<sup>51/</sup> Among other things, the FCC proposes to allow fixed white space device antennas at a height above ground of more than 30 meters in rural areas and asks what the appropriate co- and adjacent-channel separation distances would be if the antenna height limit were raised.<sup>52/</sup> The Commission originally adopted the 30 meter limit in order to decrease the potential for harmful interference to authorized services, but said that it would revisit the limit if experience with white space devices indicated that they could operate at higher antenna heights without increasing interference to licensed services.<sup>53/</sup> Additionally, the FCC asks whether it should allow fixed white space devices in rural areas to operate with up to 10 watts EIRP.<sup>54/</sup>

The Commission should increase the antenna height limits for fixed devices in rural areas, which would increase the maximum distance at which a signal could be received in those areas. As the Commission recognizes, there are fewer authorized spectrum users in rural areas, thus the potential for harmful interference is lower.<sup>55/</sup> Although it is true that the range at which a white space device could potentially cause interference to authorized services increases as the

---

<sup>51/</sup> *Id.* ¶¶ 44-53. The Commission proposes to define “rural” for purposes of white space device operations as “those where at least half of the TV channels are unused for broadcast services and available for white space use.” *Id.* ¶ 45. Wi-Fi Alliance urges the Commission to instead define “rural” based on population per kilometer.

<sup>52/</sup> *Id.* ¶ 47.

<sup>53/</sup> *Id.* ¶ 46; *see also* 47 C.F.R. § 15.709(b)(2); *White Spaces Second Report and Order* ¶ 228 (establishing the 30 meter antenna height limit); *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Third Memorandum Opinion and Order, 27 FCC Rcd. 3692, ¶ 14 (2012) (“*White Spaces Third MO&O*”) (declining to raise the limit for fixed device antenna height above ground level to 75 meters).

<sup>54/</sup> NPRM ¶¶ 48-50.

<sup>55/</sup> *Id.* ¶ 47.

device's antenna height increases,<sup>56/</sup> there are generally more white space channels available in rural areas than in more congested areas, reducing concerns regarding multiple users competing for spectrum.<sup>57/</sup> For the same reason, Wi-Fi Alliance also supports the proposal to increase the power limit for fixed devices in rural areas, which could be achieved through the use of higher gain antennas. Increasing the power limit will improve broadband service coverage in rural areas and will result in more efficient spectrum use since the power from the higher gain antenna will be concentrated in a narrower beamwidth, thereby decreasing the likelihood of interference. Moreover, the white space database can effectively manage the approximate distance to which devices can transmit by specifying the permissible transmitter power, taking into consideration antenna height. While the white space database should be able to permit use of higher-powered and higher antenna fixed devices *everywhere* based on its assessment of the spectrum landscape, authorization in rural areas is a good beginning.

**7. The Commission should generally adopt the proposed power limits for personal/portable devices in rural areas.**

In addition to proposing to amend its rules to facilitate fixed white space device operations in rural areas, the Commission also proposes changes to permit more flexible use of personal/portable devices in those areas.<sup>58/</sup> Specifically, the Commission seeks comment on whether to permit personal/portable devices to operate at a higher power in rural areas and, if so, what the maximum power should be.<sup>59/</sup> Currently, personal/portable white space devices are only permitted at a maximum 100 milliwatts EIRP, which is significantly lower than the four

---

<sup>56/</sup> See *id.* ¶ 46; *White Spaces Third MO&O* ¶ 7.

<sup>57/</sup> NPRM ¶ 47.

<sup>58/</sup> *Id.* ¶¶ 51-53.

<sup>59/</sup> *Id.* ¶ 53.

watts EIRP permitted for fixed devices.<sup>60/</sup> The FCC explained in adopting the lower power limits that personal/portable devices pose a greater risk of harmful interference to authorized services since they are able to change locations, which makes finding unused frequencies and identifying potentially interfering devices more difficult.<sup>61/</sup> Although recognizing these concerns, the FCC determines in the NPRM that higher-powered personal/portable operations may be viable in rural areas where the risk of causing harmful interference is decreased.<sup>62/</sup>

Wi-Fi Alliance encourages the FCC to increase the power for personal/portable devices in rural areas and recommends that the Commission establish the same power limit as is proposed for fixed devices operating in rural areas – *i.e.*, up to 10 watts.<sup>63/</sup> As the FCC acknowledges, there are a greater number of television channels in rural areas available for use by white space devices, thus the potential for those devices to cause harmful interference to authorized services is greatly decreased. Further, as noted above, the white space database can, similar to fixed devices, specify appropriate operating parameters (including power) based on the spectrum landscape.<sup>64/</sup> In rural areas, the database will likely find it feasible to permit higher

---

<sup>60/</sup> *Id.* ¶ 51; 47 C.F.R. § 15.709(a)(2).

<sup>61/</sup> NPRM ¶ 51; *see also White Spaces Second Report and Order* ¶¶ 116, 126 (adopting the 100 milliwatt power limit); *Unlicensed Operation in the TV Broadcast Bands; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Second Memorandum Opinion and Order, 25 FCC Rcd. 18694, ¶ 78 (2010) (declining to increase the power limit for personal/portable devices).

<sup>62/</sup> NPRM ¶ 52.

<sup>63/</sup> *See id.* ¶ 49. Personal/portable operations at power levels up to 10 watts would, of course, continue to be subject to the Commission's RF exposure rules. For most portable systems operating below 1 GHz, maximum power will be limited to three watts EIRP.

<sup>64/</sup> *See* 47 C.F.R. § 15.711(b)(1)-(2) (requiring the coordinates of both fixed and Mode II personal/portable devices to be determined with an accuracy of +/- 50 meters).

power because of the reduced presence of TV operations. This capability will serve to resolve any interference issues.<sup>65/</sup>

## **8. The channel bonding and channel aggregation rules should be amended.**

The FCC seeks comment on several rules changes to its channel bonding and channel aggregation requirements.<sup>66/</sup> Among other things, it proposes to modify its rules to specify that the adjacent channel emissions limits found in Section 15.709(c)(1) do not apply within an adjacent channel that is being used by the same white space device.<sup>67/</sup> As the Commission notes, the current out-of-band emissions (“OOBE”) rules were adopted under the assumption that white space devices would transmit on a single six-megahertz television channel. However, a white space device can use two or more channels simultaneously, whether non-contiguous (channel aggregation) or contiguous (channel bonding).<sup>68/</sup> Where a white space device is operating on multiple contiguous channels, the Commission proposes to apply the Section 15.709(c)(1) emissions limits within the six megahertz bands immediately above and below the edges of the band of contiguous channels being used.<sup>69/</sup> Similarly, the FCC proposes to modify Section 15.709(c)(2) so that white space devices operating on multiple non-contiguous channels must

---

<sup>65/</sup> As discussed more fully below, Wi-Fi Alliance does not believe that the 60-second position re-checking requirement is necessary for personal/portable devices. *See* 47 C.F.R. § 15.711(b)(2) (“A Mode II device must also re-establish its position each time it is activated from a power-off condition and use its geo-location capability to check its location at least once every 60 seconds while in operation, except while in sleep mode, *i.e.*, in a mode in which the device is inactive but is not powered-down.”). If the device does not move while in operation, then re-checking should not be required.

<sup>66/</sup> NPRM ¶¶ 54-57.

<sup>67/</sup> *Id.* ¶ 56; *see also* 47 C.F.R. § 15.709(c)(1).

<sup>68/</sup> NPRM ¶ 55.

<sup>69/</sup> *Id.* ¶ 56.

comply with the adjacent channel emission limits in the six megahertz bands above and below each of the single channels or channel groups used by the white space device.<sup>70/</sup>

Wi-Fi Alliance agrees with the proposed revisions to the channel bonding and aggregation rules. These proposals are a logical extension, to multiple channels, of the rules currently applicable to single-channel occupancy, an exercise not undertaken in the original white space rules. Wi-Fi Alliance proposes a multiplicative factor for total power allowed on bonded multiple channels based on the number of channels occupied. This approach yields the same power spectral density (“PSD”) for purposes of OOB requirements, and thus would create no increased risk for interference.

The Commission also proposes to add emission limits for fixed devices operating at the proposed new power levels that are less than four watts EIRP and to correct the method of specifying the emission limits for fixed devices using high gain antennas – *i.e.*, those greater than 6 dBi.<sup>71/</sup> Specifically, the FCC proposes to modify its rules to require that adjacent channel emissions limits for fixed devices be reduced by the amount of dB that the antenna gain exceeds 6 dBi.<sup>72/</sup> The Commission also outlines adjacent channel emission limits corresponding to the additional conducted power levels below 30 dBm that are being proposed for fixed devices.<sup>73/</sup>

For fixed devices, Wi-Fi Alliance agrees that the adjacent channel limits should be reduced by the amount in dB that the gain exceeds 6 dBi. This approach is consistent with the

---

<sup>70/</sup> *Id.* ¶ 57.

<sup>71/</sup> *Id.* ¶ 58.

<sup>72/</sup> *Id.* ¶ 61.

<sup>73/</sup> *Id.* ¶¶ 59-60. The proposed limits are calculated using the methodology in the *White Spaces Third MO&O* and would permit adjacent channel emissions limits of -62.8, -58.8, -54.8, -50.8, -46.8, and -42.8 dBm for conducted power limits of 10, 14, 18, 22, 26, and 30 dBm, respectively. *Id.* ¶ 59; *see also White Spaces Third MO&O* ¶ 29.



methodology used to determine compliance with the PSD limits for fixed devices.<sup>74/</sup> The proposed table and methodology gives greater flexibility for implementing white space solutions. Specifically, the database can allow for lower conducted power at locations which would not otherwise have access to a channel with -42.8 dBm. This rule will therefore “provide for lower power white space devices to operate closer to the TV contours than higher power devices.”<sup>75/</sup>

**9. The proposed propagation model for determining separation distances from television station contours is not appropriate.**

White space devices must protect the defined service contours of television stations, which are currently calculated using the methodology found in Sections 73.684 and 73.699 of the Commission’s rules. Fixed devices must operate outside the contours of both co- and adjacent-channel television stations, while personal/portable devices operating at a maximum of 40 milliwatts need only comply with co-channel separation distances.<sup>76/</sup> The methodology used to calculate the required separation distances between white space devices and co- and adjacent-channel television contours assumes use of a fixed white space device operating at an EIRP of four watts.<sup>77/</sup> The FCC proposes to amend the table of separation distances to reflect the proposal to permit fixed device operations at power levels below four watts.<sup>78/</sup> Because the Commission proposes to calculate required separation distances for fixed devices at 40 milliwatts and 100 milliwatts EIRP, it also proposes to apply those separation distances to personal/portable

---

<sup>74/</sup> NPRM ¶ 61.

<sup>75/</sup> *Id.* ¶ 60.

<sup>76/</sup> See 47 C.F.R. § 15.712(a)(2). Personal/portable devices operating above 40 milliwatts and up to the maximum 100 milliwatts must comply with both the co- and adjacent-channel separation distances. *Id.*; see also NPRM ¶ 63.

<sup>77/</sup> NPRM ¶ 64; see also *White Spaces Third MO&O* ¶ 18.

<sup>78/</sup> NPRM ¶ 65.

devices.<sup>79/</sup> The FCC also seeks comment on what propagation model should be used for calculating interference contours<sup>80/</sup> and whether to modify its rules to consider the directional antenna pattern for fixed white space devices.<sup>81/</sup>

Wi-Fi Alliance supports the proposal to adopt reduced separation distance specifications for fixed devices that operate below four watts EIRP and to apply appropriate separation distances to personal/portable white space devices. By removing the presumption that fixed devices will always operate at the maximum four watts, the FCC will increase the locations at which both fixed and personal/portable devices may operate.<sup>82/</sup> Additionally, the Commission should adopt its proposal to take into account directional antenna patterns when calculating separation distances. When the table of separation distances for white space devices was adopted, the FCC considered the directivity of the television receive antenna, but not the directivity of the white space device transmit antenna.<sup>83/</sup> Where directional antennas are used, separation distances can be reduced even more for fixed devices. In order to ensure the accuracy of antenna patterns, such information could be stored, consistent with the recommendations contained in European Telecommunications Standards Institute (“ETSI”) Standard EN 301 598.<sup>84/</sup>

---

<sup>79/</sup> *Id.*

<sup>80/</sup> *Id.* ¶¶ 70-72.

<sup>81/</sup> *Id.* ¶¶ 73-75.

<sup>82/</sup> *See id.* ¶ 65.

<sup>83/</sup> *Id.* ¶ 73; *see also White Spaces Second Report and Order* ¶¶ 177, 181; *White Spaces Third MO&O* ¶ 17.

<sup>84/</sup> *See White Space Devices (WSD); Wireless Access Systems Operating in the 470 MHz to 790 MHz Frequency Band; Harmonized EN Covering the Essential Requirements of Article 3.2 of the R&TTE Directive*, ETSI EN 301 598 v1.1.1 (2014), available at [http://www.etsi.org/deliver/etsi\\_en/301500\\_301599/301598/01.01.01\\_60/en\\_301598v010101p.pdf](http://www.etsi.org/deliver/etsi_en/301500_301599/301598/01.01.01_60/en_301598v010101p.pdf) (“ETSI 301 598”).

However, Wi-Fi Alliance disagrees with the proposed propagation model for calculating interference contours. The Commission proposes to use the TM 91-1 model – which predicts field strength levels taking into consideration frequency, distance, transmitting and receiving antenna heights, and building penetration losses<sup>85/</sup> – to calculate separation distances. The TM 91-1 propagation model is the wrong approach for several reasons. First, it underestimates building penetration loss, which means that white space devices will be underutilized at higher powers. While TM 91-1 indicates that loss is between 6.4 dB and 7.1 dB between 500 MHz and 700 MHz, the 700 MHz broadband network demonstrates that the 700 MHz loss is much more than 12 dB – more than 5 dB higher than TM 91-1 suggests.<sup>86/</sup> TM 91-1 also discusses suburban residential construction in building penetration loss, not urban construction, so it undervalues the loss in general. Additionally, the TM 91-1 model does not adequately take into account antenna heights, as it was based on antennas at up to 30 feet above ground, which are hardly appropriate for calculating protection in urban areas.<sup>87/</sup> Further, while TM 91-1 takes freespace path loss into account like other propagation models, it does not account for urban clutter loss and building penetration, which is particularly problematic since white space device operations will likely be fixed and occur indoors, and using only the Hata model with a constant building attenuation is also insufficient.<sup>88/</sup>

---

<sup>85/</sup> See William Daniel and Harry Wong, Office of Engineering and Technology, FCC, *Propagation in Suburban Areas at Distances Less Than Ten Miles*, FCC/OET TM 91-1, at 2 (Jan. 25, 1991), available at <http://transition.fcc.gov/oet/info/documents/technical/tm91-1.pdf> (“TM 91-1”).

<sup>86/</sup> See C.L. Holloway, et al., National Institute of Standards and Technology, U.S. Department of Commerce, *Attenuation of Radio Wave Signals Coupled Into Twelve Large Building Structures*, NIST Technical Note 1545 (Aug. 2008), available at [http://www.eeel.nist.gov/kate\\_papers/R12\\_TN1545.pdf](http://www.eeel.nist.gov/kate_papers/R12_TN1545.pdf).

<sup>87/</sup> See TM 91-1 at 4.

<sup>88/</sup> See NPRM ¶¶ 70, 72 (seeking comment on whether the FCC should consider using other propagation models, such as the Hata models). As the Commission notes, the “Hata models are widely used to predict the behavior of cellular transmissions in urban, suburban and open areas” and “are valid over the frequency range of 150 to 1500 MHz.” *Id.* ¶ 72, n.106.

**10. The Commission should generally adopt its proposals regarding location accuracy.**

As explained above, the Commission's rules permit two types of personal/portable devices: Mode II, which must incorporate a geo-location capability that can determine its geographic coordinates within 50 meters, and Mode I, which need not.<sup>89/</sup> Among other things, the FCC seeks comment on whether devices need to determine their position with this level of accuracy in order to protect authorized services.<sup>90/</sup> To that end, it asks whether it should permit white space devices to use geo-location methods that are less accurate than the current rules require – provided, of course, that the methods continue to provide the same level of protection for authorized services.<sup>91/</sup>

Devices with less location accuracy than the current rules require should be permitted so long as the same level of protection is provided. Devices should be able to provide their accuracy to a database, and the database will be able to adjust the protection and channel assignment accordingly. The database will be able to factor in a device's level of accuracy in specifying the power level and channel for which use is permitted. A device that cannot provide a 50-meter accuracy can still operate effectively in the repurposed 600 MHz band, as long as it protects higher priority users by operating consistent with its location capabilities, as recognized by the database. The FCC should allow location accuracy to be a characteristic of each device and allow databases to calculate interference based upon, among other parameters, the reported accuracy (*i.e.*, the certainty of the latitude, longitude, and altitude) of the individual device. This approach would continue to protect incumbent operations but allow less precise devices to

---

<sup>89/</sup> *Id.* ¶¶ 20, 76; 47 C.F.R. § 15.703(c), (f), (g). Mode I devices instead obtain a list of available channels from either a fixed or Mode II device.

<sup>90/</sup> NPRM ¶ 76.

<sup>91/</sup> *Id.* ¶ 77.

operate in all the areas that are consistent with their location accuracy, with those devices appropriately reporting any accuracy degradation that may occur over time. Moreover, it is not necessary to detect location within 50 meters in order to protect incumbent operations.<sup>92/</sup> Allowing white space devices to operate with less than 50 meter accuracy, so long as they are able to report their level of accuracy to the white space database, is crucial to the success of white space technology.

## **B. 600 MHz Guard Bands**

The Commission seeks comment on a variety of proposals which would allow the operation of fixed and personal/portable devices in the 600 MHz guard bands and duplex gap.<sup>93/</sup> Operations in the guard band would be required to protect both broadcast television services and licensed wireless downlink services.<sup>94/</sup> Although personal/portable devices are currently permitted to operate on channels immediately adjacent to an occupied television channel – and the FCC is proposing, as detailed above, to permit fixed devices to operate three megahertz away from an occupied television channel – there are no rules to protect wireless downlink services adjacent to the guard bands. The FCC therefore proposes to protect wireless handsets by limiting the authorized power of white space devices operating in the guard bands and to require a buffer

---

<sup>92/</sup> See also *Wireless E911 Location Accuracy Requirements*, Fourth Report and Order, FCC 15-9, PS Docket No. 07-114, ¶¶ 78-79 (2015) (noting that commenters in the FCC’s E911 proceeding asserted in the context of 911 location accuracy that a 50-meter horizontal accuracy requirement may not be technologically reasonable today).

<sup>93/</sup> NPRM ¶¶ 78-96. The 600 MHz band plan provides for a guard band between television spectrum and the 600 MHz downlink; a guard band between the 600 MHz uplink and downlink (the duplex gap); and guard bands between the 600 MHz downlink and channel 37. *Id.* ¶ 78; *Incentive Auction Report and Order* ¶ 270. The location and size of the guard bands will depend on the amount of spectrum that is relinquished by broadcasters and recovered through the incentive auction, but the duplex gap will be 11 megahertz wide under all spectrum recovery scenarios. NPRM ¶¶ 8, 78; *Incentive Auction Report and Order* ¶¶ 270-71. Guard band spectrum will total between 14 and 28 megahertz, depending on the amount of spectrum recovered in the incentive auction. *Incentive Auction Report and Order* ¶ 270.

<sup>94/</sup> NPRM ¶ 81.

between the edge of the channel used by the white space device and the wireless downlink services.<sup>95/</sup>

Wi-Fi Alliance supports this approach. The Commission should permit both fixed and personal/portable white space devices to operate in the guard bands, including both Mode I and Mode II devices. The proposed approach, including a buffer between white space devices and wireless downlink services, as well as the reduced power levels, will adequately protect wireless handset operations.<sup>96/</sup>

### **C. 600 MHz Duplex Gap**

#### **1. The Commission should divide the duplex gap.**

The Commission proposes to allow fixed and personal/portable white space devices, as well as unlicensed microphones, to operate in the six-megahertz portion at the upper end of the duplex gap and to reserve four megahertz immediately below the six-megahertz portion to be used exclusively by licensed wireless microphones.<sup>97/</sup> The FCC also proposes to designate the remaining one megahertz as a buffer between licensed wireless microphones and wireless downlink spectrum below the duplex gap.<sup>98/</sup>

Wi-Fi Alliance generally supports this division of the duplex gap. Although, as noted below, there may be justification for slight modification of the division of the spectrum, dedicating some of the band for wireless microphones will help satisfy the demand for that application, particularly in light of the decreased availability of other spectrum for wireless

---

<sup>95/</sup> *Id.*

<sup>96/</sup> Nevertheless, as detailed above, the Commission should not use the TM 91-1 propagation model to calculate the required separation distances.

<sup>97/</sup> NPRM ¶¶ 91-92.

<sup>98/</sup> *Id.* ¶ 92. The one-megahertz separation between licensed wireless microphones and the downlink spectrum is designed to provide an additional layer of interference protection for mobile handsets. *Id.*

microphones. The majority of the duplex gap should be available for, as the Commission proposes, white space devices in order to provide a consistent amount of spectrum in all geographic areas to spur the development of white space technology.

**2. Fixed and personal/portable devices should be permitted to operate with a power level of 40 milliwatts.**

The Commission should adopt its proposal to allow fixed and personal/portable white space devices to operate in the six-megahertz segment of the duplex gap at a 40-milliwatt power level.<sup>99/</sup> The proposed transmit power level is useful for white space device operations and is similar to the power used in personal/portable devices in the white space spectrum. By adopting this proposal, the Commission will promote consistency throughout the 600 MHz bands, which will in turn foster a robust equipment market.

**3. A one-megahertz gap between white space devices and LTE uplink is appropriate.**

While the Commission proposes to adopt a one-megahertz buffer between the wireless downlink spectrum and licensed wireless microphones, it does not propose to create a similar barrier at the upper end of the duplex gap. Although the FCC correctly notes that a buffer is not necessary at the upper portion of the duplex gap to protect licensed wireless uplink services,<sup>100/</sup> a one-megahertz gap could be beneficial to protect unlicensed operations from interference by uplink operations. Wi-Fi Alliance recognizes that, as Part 15 operators, white space devices are not entitled to interference protection, either from licensed services or from other unlicensed operations. However, creating a one-megahertz buffer between white space devices and LTE uplink will help to ensure that unlicensed operations can flourish in the duplex gap without suffering excessive interference, while at the same time providing an added layer of protection

---

<sup>99/</sup> *Id.* ¶ 96.

<sup>100/</sup> *Id.*

for LTE operations. Wi-Fi Alliance therefore urges the Commission to explore ways to provide a one-megahertz buffer between white space devices and LTE uplink. While not the only solution, one potential way to address this issue is to require licensed wireless microphones to operate on a three-megahertz – rather than four-megahertz – allocation, making the total amount of wireless microphone and white space/unlicensed spectrum equal ten megahertz, which will facilitate a one-megahertz buffer between licensed and unlicensed operations.

#### **D. Channel 37**

In the *Incentive Auction Report and Order*, the Commission decided to revisit its previous decision to prohibit unlicensed operations on channel 37. Today, channel 37 is allocated for receive-only Radio Astronomy Service (“RAS”) observations and for WMTS operations.<sup>101/</sup> Although recognizing the importance of protecting WMTS and RAS operations from harmful interference, the Commission attempted to balance the loss of channels available for white space operations after the repurposing of spectrum following the incentive auction.<sup>102/</sup> The FCC therefore determined to permit unlicensed operations on channel 37 at locations sufficiently removed from WMTS users and RAS sites, thereby making an additional six megahertz of spectrum available for unlicensed devices in areas where such operations would not be in close proximity to hospitals, other medical facilities, or RAS sites.<sup>103/</sup>

---

<sup>101/</sup> See 47 C.F.R. § 2.106, n. US 246; see also NPRM ¶¶ 97-98; *Amendment of Parts 2 and 95 of the Commission’s Rules to Create a Wireless Medical Telemetry Service*, Report and Order, 15 FCC Rcd. 11206 (2000) (establishing the WMTS on a protected basis in the 608-614 MHz, 1395-1400 MHz, and 1427-1432 MHz bands); *Amendment of Sections 2.106 and 73.603(c) of the Commission’s Rules and Regulations Concerning the Use of Television Channel 37 for Radio Astronomy Purposes*, Order, 53 FCC 2d 627 (1975) (protecting the use of channel 37 for RAS on a permanent basis). WMTS operations in the 608-614 MHz band are required to coordinate with certain RAS observatories prior to operation in order to protect RAS from in-band harmful interference and must operate under specified field strength limits. NPRM ¶ 98; see also 47 C.F.R. §§ 95.1115(a)(1), 95.1119.

<sup>102/</sup> *Incentive Auction Report and Order* ¶ 276.

<sup>103/</sup> *Id.* ¶¶ 274-76; NPRM ¶ 99.



The Commission now seeks comment on a variety of proposals designed to implement this decision.<sup>104/</sup> In general, Wi-Fi Alliance supports the FCC’s technical proposals with regard to unlicensed operations on channel 37, with the exception of the proposed methodology for calculating minimum separation distances. The Commission should adopt rules that will maximize the opportunities for white space device operations, bearing in mind the important goal of protecting RAS and life-saving WMTS operations.

**1. Fixed and Modes I and II personal/portable devices should be permitted on channel 37.**

The Commission proposes several approaches to operations on channel 37.<sup>105/</sup> Wi-Fi Alliance supports the less conservative approach of permitting all three types of devices to operate on channel 37 – *i.e.*, fixed, Mode II, and Mode I devices. Although Mode I devices do not have geo-location capabilities, they must be able to communicate with a fixed or Mode II device in order to obtain a list of available channels on which they may operate (or, as Wi-Fi Alliance suggests, secure a channel assignment and other technical parameters from the database).<sup>106/</sup> Thus, because they cannot operate without database approval – through their communications with fixed or Mode II devices – Mode I devices will continue to protect channel 37 operations in the same way they are protected against fixed and Mode II devices. As stated above, because access will be controlled by a database that will know the device’s operating parameters, there is no need for a distinction between fixed and personal/portable devices.

---

<sup>104/</sup> See generally NPRM ¶¶ 100-128.

<sup>105/</sup> *Id.* ¶¶ 101-102.

<sup>106/</sup> 47 C.F.R. § 15.703(e).

**2. The Commission should generally adopt the proposed maximum proposed power limits and technical requirements for operations on channel 37.**

In order to provide consistency across the unlicensed spectrum bands, Wi-Fi Alliance agrees that the Commission should allow the same maximum power limit on channel 37 for fixed and personal/portable white space devices as are permitted in the TV Bands.<sup>107/</sup> Accordingly, the Commission should adopt its proposal to permit fixed white space devices to operate at a maximum of four watts EIRP and personal/portable devices to operate at a maximum of 100 milliwatts EIRP. The rules for operation of white space devices should be as consistent as possible across the permissible spectrum segments in order to promote innovation and maximize the utility of unlicensed devices.

The Commission should also adopt the other technical requirements it proposes.<sup>108/</sup> Specifically, the Commission proposes to require white space devices operating on channel 37 to meet the conducted power, antenna gain, and PSD limits, as appropriate, as white space devices operating in other bands, as well as to require white space devices operating on channel 37 to access a database to determine if channel 37 is available in a particular area.<sup>109/</sup> Requiring white space devices to operate based on the proposed requirements will help to ensure that unlicensed devices are provided ample opportunities to operate and innovate without putting important public safety operations at risk of harmful interference.

Wi-Fi Alliance also agrees with the Commission's proposal to vary the permissible power levels depending on the devices that operate in adjacent bands.<sup>110/</sup> If less than 84

---

<sup>107/</sup> NPRM ¶ 103.

<sup>108/</sup> *Id.*

<sup>109/</sup> *Id.*

<sup>110/</sup> *Id.* ¶¶ 104, 108.

megahertz is recovered in the reverse auction, channels 36 and 38 will continue to be available for television broadcasting, thus there will be little change from the current spectrum landscape.<sup>111/</sup> The FCC therefore proposes to permit a maximum allowable power limit for fixed and personal/portable devices of four watts and 100 milliwatts, respectively, when those devices are operating on channel 37 adjacent to vacant channels 36 and 38; a maximum of 40 milliwatts where neither channel 36 nor channel 38 is vacant; and a maximum of four watts for fixed devices, centered on the boundaries of channel 37 and the unoccupied channel, where only one of channels 36 or 38 is available. This proposal is consistent with the rules proposed for TV Band operations and would thus provide consistency for white space devices operations. Wi-Fi Alliance therefore supports the FCC's proposal to reduce the acceptable power limits where channels 36 and 38 are both occupied and to center operations with full power when only one channel is occupied.

**3. The Commission should adopt a different methodology for calculating WMTS and Very Long Baseline Array ("VLBA") separation distances.**

In order to protect WMTS systems, which are generally used by patients in hospital settings to transmit and receive vital medical information, the Commission proposes minimum co- and adjacent-channel separation distances for white space devices operating on channel 37, which it calculated based on the TM 91-1 propagation model.<sup>112/</sup> As Wi-Fi Alliance noted above, the FCC should not rely on the TM 91-1 model. Among other things, this model underestimates building penetration loss, fails to adequately account for antenna heights, and fails to account for urban clutter loss.

---

<sup>111/</sup> *Id.* ¶ 104.

<sup>112/</sup> *See id.* ¶¶ 109-115.

The Commission also proposes separation distances for RAS observatories and VLBA stations in order to protect those operations from harmful interference.<sup>113/</sup> The Commission determined that it is appropriate to define minimum separation distances for the VLBA stations differently than it does for the two single-dish RAS observatories that receive on channel 37, finding that VLBA stations are less susceptible to interference than RAS observations since interfering signals do not correlate across the multiple receivers that comprise the array.<sup>114/</sup> Accordingly, it proposes to define exclusion zones around the two single-dish RAS observatories that receive on channel 37, in which white space devices may not operate.<sup>115/</sup> For VLBA stations, the Commission calculates minimum co-channel separation distances based on a detailed propagation model described in the NPRM.<sup>116/</sup>

Although Wi-Fi Alliance agrees with the proposal to establish exclusion zones around the two RAS observatories operating on channel 37,<sup>117/</sup> it disagrees with the proposed co-channel separation distances for VLBA stations and, in particular, the methodology used to calculate them.<sup>118/</sup> As the Commission notes, the calculation fails to account for a variety of factors that would shorten the required protection distance, including buildings, mountains, trees, and other ground clutter.<sup>119/</sup> The Commission should instead base separation distances on requested/reported transmit EIRP and local topology rather than the proposed WMTS flat earth

---

<sup>113/</sup> See *id.* ¶¶ 116-124.

<sup>114/</sup> *Id.* ¶ 116 (citing *Incentive Auction Report and Order* ¶ 293, n.885).

<sup>115/</sup> *Id.*

<sup>116/</sup> *Id.* ¶ 117.

<sup>117/</sup> See *id.* ¶¶ 122-124, 175.

<sup>118/</sup> The Commission does not propose adjacent-channel separation distances in the NPRM, but seeks comment on whether it should. See *id.* ¶ 121.

<sup>119/</sup> *Id.* ¶ 119.

methodology.<sup>120/</sup> Using this approach will continue to provide appropriate protection while recognizing real-world operating conditions.

**4. Three-megahertz guard bands around channel 37 should be available for unlicensed operations.**

The 600 MHz band plan adopted in the *Incentive Auction Report and Order* includes a three-megahertz wide guard band between channel 37 and any adjacent wireless broadband services.<sup>121/</sup> The Commission asks whether, in locations where channel 37 is not being used by WMTS or RAS operations, the three-megahertz guard band could be combined with the six-megahertz of channel 37 to create a nine-megahertz band available for unlicensed operations. The FCC also seeks comment on technical rules necessary to implement this proposal, including the power level and frequency separation that would be necessary in order to protect wireless services adjacent to the guard bands.<sup>122/</sup>

Wi-Fi Alliance encourages the Commission to permit the three-megahertz guard bands to be combined with channel 37, where available, and to permit unlicensed operations in that spectrum under the same technical rules that apply to adjacent channel 37 operations. Doing so will create more contiguous bandwidth over which unlicensed devices may operate, expanding the potential technologies that may be used in the band.

---

<sup>120/</sup> *Id.* ¶ 117. By revising the methodology in this way, the Commission will also need to revise the proposed separation distances which white space database administrators will need to require white space devices to meet. *See id.* ¶¶ 175-176.

<sup>121/</sup> *Id.* ¶ 125; *Incentive Auction Report and Order* ¶¶ 89, 279.

<sup>122/</sup> NPRM ¶ 125.

**5. The additional out-of-band emissions requirements for channels 36-38 should be removed.**

In addition to the adjacent-channel and Section 15.209 limits by which all white space devices must generally comply,<sup>123/</sup> the Commission's rules contain more stringent requirements for operations on channels 36 through 38 in order to suppress OOB into channel 37.<sup>124/</sup> This additional mask – which was originally proposed “to limit device emissions, both fundamental and spurious, in channels 36 and 38 to reduce the likelihood of overloading sensitive medical telemetry receivers”<sup>125/</sup> – was adopted for both fixed and personal/portable devices.<sup>126/</sup> The FCC now proposes to eliminate the OOB limits and require devices to instead meet either the current adjacent-channel or the Section 15.209 emission limits.<sup>127/</sup>

Wi-Fi Alliance strongly agrees with the proposal to remove the OOB requirements for channels 36 through 38. The current requirements significantly increase the cost of chips because manufacturers must incorporate an additional band-reject filter into the white space device in order to comply with the OOB limit.<sup>128/</sup> As the Commission recognizes and Wi-Fi Alliance has noted throughout these comments, the proposal to permit unlicensed operations on channel 37 includes a requirement that white space devices access a database in order to prevent against generating harmful interference to WMTS and RAS operations.<sup>129/</sup> The geographical

---

<sup>123/</sup> See 47 C.F.R. § 15.709(c)(3) (requiring white space devices to meet the emissions requirements of Section 15.209 at frequencies beyond the TV Bands immediately adjacent to the channel in which the white space device is operating); *see also* NPRM ¶ 126.

<sup>124/</sup> NPRM ¶ 126; *see also White Spaces Second Report and Order* ¶ 236.

<sup>125/</sup> Letter from Tim Kottak, Engineering General Manager, and Neal Seidl, Wireless System Architect, GE Healthcare, to Marlene H. Dortch, Secretary, FCC, ET Docket Nos. 04-186, 02-380, at 2 (dated May 6, 2008).

<sup>126/</sup> NPRM ¶ 126.

<sup>127/</sup> *Id.* ¶ 128.

<sup>128/</sup> *Id.* ¶ 126.

<sup>129/</sup> *Id.* ¶ 128.

separation that will be achieved through database access should serve to avoid any interference concerns. “Thus, there will no longer be a need for the more stringent out-of-band emission limits on channels 36 through 38.”<sup>130/</sup>

### **E. Repurposed 600 MHz Band**

The Commission decided in the *Incentive Auction Report and Order* to continue to permit the operation of white space devices in any television channels unused by broadcast television stations following the incentive auction, so long as wireless licensees have not commenced operations on those channels.<sup>131/</sup> In so doing, the Commission intended to “strike a balance between the interests of all users of the television bands.”<sup>132/</sup> The Commission now seeks comment on the specifics of those permitted operations, asking whether personal/portable devices – in addition to fixed devices – should be allowed to operate in the repurposed 600 MHz band.<sup>133/</sup> If Mode I and/or Mode II devices are permitted, the FCC asks about the specific technical rules that should govern their operation.<sup>134/</sup>

The Commission should authorize both Mode I and Mode II personal/portable devices in the repurposed 600 MHz band, consistent with Wi-Fi Alliance’s recommendation for operations in the guard bands and duplex gap. As discussed, the white space database can specify appropriate operating parameters (including power) for both fixed and personal/portable devices based on the spectrum landscape. There is therefore no reason to distinguish between the two types of devices. However, the FCC should not adopt its proposal requiring that protection from Mode II devices be based on those devices operating at a height above average terrain (“HAAT”)

---

<sup>130/</sup> *Id.*

<sup>131/</sup> *See id.* ¶ 129; *Incentive Auction Report and Order* ¶ 269.

<sup>132/</sup> *Incentive Auction Report and Order* ¶ 269.

<sup>133/</sup> NPRM ¶ 132.

<sup>134/</sup> *Id.*

less than three meters.<sup>135/</sup> White space devices will only operate where wireless licensees have not commenced operations. Therefore, full use should be permitted by white space devices in those areas. There is no reason to impose HAAT restrictions in the repurposed 600 MHz band when no similar restrictions are proposed (or required) in other portions of the reallocated spectrum. Additionally, as stated above, the Commission should not use the TM 91-1 propagation model to calculate separation distances to protect 600 MHz band base stations.<sup>136/</sup>

### III. WIRELESS MICROPHONES

#### A. Unlicensed Wireless Microphones in the TV Bands

##### 1. Unlicensed wireless microphones should comply with the Part 74 technical standards.

Today, wireless microphones are permitted to operate in the TV Bands either on a licensed basis pursuant to Part 74<sup>137/</sup> or an unlicensed basis pursuant to the technical requirements of Part 15.<sup>138/</sup> Operators of Part 74 wireless microphones may register their operations in the TV Bands databases to obtain interference protection from white space devices at certain times and locations of operations.<sup>139/</sup> While operators of unlicensed wireless

---

<sup>135/</sup> *Id.*

<sup>136/</sup> *See id.* ¶ 135.

<sup>137/</sup> *See* 47 C.F.R. Part 74 (permitting low power auxiliary stations – which are intended to transmit over distances of approximately 100 meters for uses such as wireless microphones, cue-and-control communications, and TV camera signal synchronization – to operate in the TV Bands); *see also* NPRM ¶ 6.

<sup>138/</sup> *See Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band; Public Interest Spectrum Coalition Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, in the Digital Television Transition; Amendment of Parts 15, 74 and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones*, Report and Order and Further Notice of Proposed Rulemaking, 25 FCC Rcd. 643 (2010) (“TV Bands Wireless Microphones Report and Order”) (granting a waiver of Part 15 to permit the operation of wireless microphones in the VHF and UHF TV Bands on an unlicensed basis).

<sup>139/</sup> NPRM ¶ 6; *see also* 47 C.F.R. § 15.713(h)(8); *Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band; Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital*



microphones could not generally register in the TV Bands databases, they could do so if they were operating large numbers of wireless microphones and satisfied certain other specified criteria.<sup>140/</sup> In granting a waiver to permit unlicensed wireless microphones to operate in the TV Bands, the Commission recognized the significance of wireless microphones in providing quality audio technology and stated that such operations would continue to be permitted until Part 15 rules could be established for unlicensed wireless microphone operations.<sup>141/</sup>

The Commission now proposes to permit unlicensed wireless microphones to operate in the TV Bands on channels 2-51 (excluding channel 37 in all locations and channel 17 in Hawaii) and to require such operations at least four kilometers outside the same protected service contours of co-channel TV stations as adopted for Part 74 wireless microphones.<sup>142/</sup> The Commission continues to believe that it should codify, in Part 15, rules for the operation of unlicensed wireless microphones in the TV Bands, but proposes to do so under a modified set of proposals.<sup>143/</sup> Specifically, the Commission proposes to permit wireless microphones to operate with a power level to the antenna of up to 50 milliwatts in both the VHF and UHF TV Bands and

---

*Television Transition; Amendment of Parts 15, 74 and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones*, Second Report and Order, 29 FCC Rcd. (2014) (“*TV Bands Wireless Microphones Second Report and Order*”) (expanding Part 74 license eligibility to include professional sound companies and owners and operators of large venues that routinely use 50 or more wireless microphones, where their use is an integral part of the major productions or events they host).

<sup>140/</sup> NPRM ¶ 6; *see also* 47 C.F.R. § 15.713(h)(9).

<sup>141/</sup> *See TV Bands Wireless Microphones Report and Order* ¶¶ 52, 81, 87; *see also* NPRM ¶ 145.

<sup>142/</sup> NPRM ¶¶ 149-150; *see also Incentive Auction Report and Order* ¶ 305.

<sup>143/</sup> NPRM ¶ 146.

to comply with the same channelization, frequency stability, and bandwidth requirements as Part 74 licensed wireless microphones.<sup>144/</sup>

Wi-Fi Alliance agrees with the proposal that unlicensed microphones comply with the technical rules applicable to licensed wireless microphones. As the Commission recognizes, the proposed 25 kHz offset requirement would help prevent interference to television stations on adjacent channels and the bandwidth limit will leave room for multiple wireless microphones to operate within a channel.<sup>145/</sup> These technical rules applicable to licensed wireless microphone operations have effectively protected television operations in the past and there is no evidence that they would not do so in the future.

## **2. Unlicensed wireless microphones should comply with the ETSI emission mask standard.**

The Commission also proposes to require unlicensed wireless microphones to comply with the same emission mask requirements that it proposes for licensed Part 74 wireless microphones in the companion Wireless Microphone proceeding<sup>146/</sup> – *i.e.*, that emissions from analog and digital unlicensed wireless microphone comply with the emissions masks in ETSI standard EN 300 422-1 – and seeks comment on this proposal.<sup>147/</sup> Where wireless microphones operate outside the frequency range where the ETSI masks are defined – *i.e.*, one megahertz

---

<sup>144/</sup> *Id.* ¶¶ 151-152 (proposing to require unlicensed microphones to operate offset from the upper or lower channel edge by 25 kHz or an integral multiple thereof and that operating frequency tolerance not exceed 200 kHz).

<sup>145/</sup> *Id.* ¶ 152.

<sup>146/</sup> *See Promoting Spectrum Access for Wireless Microphone Operations; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 29 FCC Rcd. 12343, ¶¶ 87-92 (2014) (“Wireless Microphone NPRM”).

<sup>147/</sup> NPRM ¶ 153; *see also Electromagnetic Frequency Range; Part 1: Technical Characteristics and Methods of Measurement*, ETSI EN 300 422-1 (2011), available at [http://www.etsi.org/deliver/etsi\\_en/300400\\_300499/30042201/01.04.02\\_60/en\\_30042201v010402p.pdf](http://www.etsi.org/deliver/etsi_en/300400_300499/30042201/01.04.02_60/en_30042201v010402p.pdf).

above and below the wireless microphone carrier frequency – the Commission proposes to require them to comply with the emission limits found in Section 15.209.<sup>148/</sup>

Wi-Fi Alliance agrees that unlicensed wireless microphones should comply with the ETSI emission mask. Compliance with international standards will produce economies of scale and scope and will improve spectrum sharing by wireless microphones. Importantly, as the Commission notes, the tighter ETSI standards will offer more protection for authorized services in adjacent bands.<sup>149/</sup> However, the FCC should not adopt its proposal that emissions not be attenuated below the Section 15.209 limits even if the ETSI mask would require greater attenuation.<sup>150/</sup> Instead, compliance with the ETSI standard should be required in either case, which will help to simplify the compliance process. Similarly, where the ETSI mask is more stringent than Section 15.209, the ETSI mask should apply in order to create consistency across devices and provide greater protection.

### **B. Wireless Microphones in the 600 MHz Guard Bands and Duplex Gap**

In the *Incentive Auction Report and Order*, the Commission determined to permit unlicensed devices, including unlicensed wireless microphones, to operate in the 600 MHz guard bands and duplex gap.<sup>151/</sup> The Commission now proposes to require unlicensed wireless microphones that operate in the guard band and duplex gap to meet many of the same technical requirements proposed for unlicensed wireless microphones operating in the TV Bands, including the same channelization, bandwidth, frequency stability, and emission mask

---

<sup>148/</sup> NPRM ¶ 154.

<sup>149/</sup> *Id.* ¶ 154; *see also Wireless Microphone NPRM* ¶ 88.

<sup>150/</sup> NPRM ¶ 154.

<sup>151/</sup> *Id.* ¶¶ 9, 158; *Incentive Auction Report and Order* ¶¶ 22-24.

requirements.<sup>152/</sup> Additionally, the Spectrum Act requires that unlicensed use of the guard bands rely on a database or other methodology.<sup>153/</sup> The Commission therefore proposes to require that unlicensed wireless microphones confer with a database prior to operation to ensure that their intended operating frequencies are available for unlicensed wireless microphone operations at the proposed location.<sup>154/</sup>

Wi-Fi Alliance agrees that the database requirement should apply to unlicensed wireless microphone operations in the guard bands and duplex gap. As the Commission notes, the database requirement is not unduly burdensome and will help unlicensed wireless microphone users identify which spectrum is available for operations.<sup>155/</sup> Moreover, there is no reason why wireless microphones operating in the guard bands and duplex gap should be subject to different access requirements than other unlicensed operations since they pose similar risks. The requirement will help ensure uniform operation of all devices in the guard bands and duplex gap – making the spectrum more available for all users. The Commission should therefore adopt its proposal to require unlicensed wireless microphones that operate in the guard bands and duplex gap to rely on a database prior to operation.

### **C. Wireless Microphones in the Repurposed 600 MHz Band**

In the *Incentive Auction Report and Order*, the Commission decided to continue to permit wireless microphone operations in the 600 MHz band during the post-incentive auction transition period. Such operations would be subject to certain conditions – they must cease operations if harmful interference is caused to any 600 MHz licensee and they must accept interference

---

<sup>152/</sup> NPRM ¶ 158.

<sup>153/</sup> *Id.* ¶ 162 (citing Spectrum Act § 6407(c)-(e)).

<sup>154/</sup> *Id.* ¶¶ 162-163.

<sup>155/</sup> *Id.* ¶ 163.

received from 600 MHz licensed operations.<sup>156/</sup> In order to implement this decision, the Commission proposes to require licensed and unlicensed wireless microphones operating in the 600 MHz band to comply with minimum separation distance requirements in order to prevent harmful interference to 600 MHz band licensees.<sup>157/</sup> The Commission asks whether to require unlicensed wireless microphone users to check a database to ensure they are outside a wireless licensee's service area, or alternatively, whether general non-interference requirements are sufficient to protect 600 MHz band licensees.<sup>158/</sup>

As noted throughout these comments and as explained further below, Wi-Fi Alliance disagrees with the proposed use of database polling generally – whether for wireless microphones operating in the repurposed 600 MHz band or for other white space devices. Instead, access by licensed wireless microphones should be based on channel validity as assigned by the database.

#### **IV. WHITE SPACE DATABASES**

##### **A. Dialogue with Database**

The Commission's rules require fixed white space devices to incorporate a geo-location capability and a means to access a database that provides a list of available television channels at their location, and the device must contact a database to obtain a channel list before operating and re-check the database at least once daily.<sup>159/</sup> Personal/portable devices, on the other hand,

---

<sup>156/</sup> *Id.* ¶ 166; *see also Incentive Auction Report and Order* ¶ 687. All wireless microphone operations must be transitioned out of the 600 MHz band no later than the end of the post-incentive auction transition period – *i.e.*, 39 months after issuance of the *Channel Reassignment Public Notice*. *Id.*

<sup>157/</sup> NPRM ¶ 167.

<sup>158/</sup> *Id.* ¶ 169.

<sup>159/</sup> *Incentive Auction Report and Order* ¶ 260 (citing 47 C.F.R. § 15.711(b)(1), (b)(3)(i)). Alternatively, fixed devices may have their geographic coordinates programmed by a professional installer. *Incentive Auction Report and Order* ¶ 260, n.789; *see also* 47 C.F. R. § 15.711(b)(1).

must contact a database to obtain a list of available channels (Mode II devices) or operate under the control of another white space device that obtains a list of available channels from a database (Mode I devices).<sup>160/</sup> The FCC stated in the *Incentive Auction Report and Order* that it planned to improve the databases in order “to make protection more timely and efficient.”<sup>161/</sup> In the NPRM, it proposes a number of revisions to the database architecture and procedures.<sup>162/</sup>

Wi-Fi Alliance urges the Commission to adopt technical rules that will maximize the times and locations in which unlicensed devices may operate in the 600 MHz band. Instead of receiving a list of available channels from the database (and then using a channel without reporting back to the database), white space devices should be affirmatively assigned a channel by the database based on the requirements specified by the white space device and the spectrum landscape in which the device is located. Channels will be assigned for a designated period of time. Some channels might have smaller validity times, and would therefore need more frequent database consultation for white space device use. Other channels (*e.g.*, VHF channels) may have more static protected services, and thus would need less frequent database consultation. So, when checking the database, a white space device would communicate its location and other relevant parameters and, in return, would learn the channel on which it is permitted to operate, the duration it may occupy a channel, and the power at which it may operate.

This scheme will eliminate the need for database rechecking during the time the use of a channel is authorized; the device will be authorized for the duration permitted by the database. Moreover, it would make the current 60-second position re-checking requirement unnecessary

---

<sup>160/</sup> *Incentive Auction Report and Order* ¶ 260 (citing 47 C.F.R. § 15.711(b)(3)(ii)-(iv)).

<sup>161/</sup> *Id.* ¶ 24.

<sup>162/</sup> *See generally* NPRM ¶¶ 170-199.

for Mode II personal/portable devices.<sup>163/</sup> If the device does not move while in operation, then re-checking should not be required. Instead, it may continue to rely on the channel assignment provided by the database. Where Mode II devices are not mobile and are powered only by a connection to the building power, the device should be required to re-establish its position and receive a new channel assignment each time it is activated from a power-off condition. For mobile equipment, the database should calculate its potential range and calculate a channel assignment accordingly. A personal/portable device can report its position and expected range of travel to the database, which will allow the database to evaluate its potential change in position and assign channels accordingly.<sup>164/</sup> With these changes, the Commission can align its rules regarding scheduling information and decrease the length of time in advance that wireless microphone operators must report their operations, allowing wireless microphone users to access channels on shorter notice when and where they need them.<sup>165/</sup>

This “closed loop” approach – in which there is greater exchange of information between the white space device and the database – is consistent with the manner by which the white space database is expected to be operated in the United Kingdom.<sup>166/</sup> An open-loop database will have less information about the location of protected operations, thus it will need to be more conservative and overprotective than where white space device usage is reported. If the database is provided with the additional information regarding the channel(s) of operation, it will be able

---

<sup>163/</sup> See *id.* ¶ 52; see also 47 C.F.R. § 15.711(b)(2).

<sup>164/</sup> See NPRM ¶ 190 (proposing to amend Sections 15.711(b)(3)(i), (ii) of the FCC’s rules to require fixed and Mode II personal/portable white space devices to re-check the database at time intervals not to exceed 20 minutes).

<sup>165/</sup> See *id.* ¶¶ 195-196; see also 47 C.F.R. § 15.711(b)(3)(i)-(ii).

<sup>166/</sup> See Ofcom, *TV White Spaces: DTT Coexistence Tests* (Dec. 17, 2014), available at [http://stakeholders.ofcom.org.uk/binaries/research/technology-research/2014/TVWS\\_DTT\\_technical\\_report.pdf](http://stakeholders.ofcom.org.uk/binaries/research/technology-research/2014/TVWS_DTT_technical_report.pdf).

to more accurately define the valid location of operation and appropriate technical parameters. This change would be consistent with ETSI Standard 301 598, which requires white space devices to notify the database on which channels they are operating.<sup>167/</sup>

Finally, device antenna patterns should be used to calculate required protection areas. The Telecommunications Industry Association's Telecommunications Systems Bulletin 10 is already used in Part 101 for terrestrial links and defines generic five-degree keyhole coordination antenna patterns.<sup>168/</sup> Any fixed white space device antenna gain greater than 12 dBi should be treated as directional, and the gain and direction of the maximum gain should be reported to the database and used in protection calculations. The database can then require protection appropriate for a directional, rather than omnidirectional, antenna.

## **B. Protection of Wireless Medical Telemetry Service**

The Commission's rules require authorized healthcare providers seeking to use WMTS devices to register all devices with an FCC-designated frequency coordinator prior to the device's operation, and such registration must include certain specific information like the geographic location of the transmitters; specific frequencies used; effective radiated power; and the number of transmitters in use.<sup>169/</sup> In order to eliminate the need for authorized healthcare providers to register their devices in both the white space database and the WMTS database, the Commission proposes to include in the white space database certain information obtained from the WMTS database.<sup>170/</sup> Specifically the Commission proposes to require the white space

---

<sup>167/</sup> See ETSI 301 598 at 19 (indicating that the white space device must communicate certain channel usage parameters to the white space database, including a list of lower and upper Digital Terrestrial Television channel edge frequencies within which the white space device intends to transmit).

<sup>168/</sup> See TIA Bulletin TSB 10-F, *Interference Criteria for Microwave Systems* (1994); see also 47 C.F.R. § 101.105(a)(5), (c).

<sup>169/</sup> See NPRM ¶¶ 170-172; 47 C.F.R. § 95.1111(a).

<sup>170/</sup> See NPRM ¶¶ 171-174.



database to include the WMTS device's frequency of operation; the geographic coordinates of the WMTS transmitters; and a cross-reference to the registration in the WMTS database.<sup>171/</sup>

In order to make the most meaningful use of channel 37 by white space devices, more detailed information regarding WMTS operations must be included in the white space database. As the Commission suggests, the information in the WMTS database may be missing or imprecise and thus may need to be updated in order to be useful to white space devices seeking to protect WMTS operations.<sup>172/</sup> More fundamentally, specifying only one location on a hospital campus is insufficient and may result in overprotection of channel 37. Including in the white space database an accurate designation of where the WMTS is actually in use is important not only to maximize the use of unlicensed devices, but also to ensure adequate protection of important WMTS operations.

### **C. Unlicensed Wireless Microphone Registration**

Finally, the Commission proposes to eliminate the ability of unlicensed wireless microphone users to register for protection in the white space database, which would prohibit them from registering their operations in the TV Bands as well as the 600 MHz guard bands and duplex gap.<sup>173/</sup> The FCC proposes this change following its recent decision to expand license eligibility for wireless microphones to extend to professional sound companies and owners and operators of large venues that routinely use 50 or more wireless microphones for their

---

<sup>171/</sup> See *id.* ¶¶ 171-172.

<sup>172/</sup> See *id.* ¶ 173.

<sup>173/</sup> *Id.* ¶ 185.

operations.<sup>174/</sup> These license eligibles can register directly in the white space database in order to protect their operations from white space devices.<sup>175/</sup>

Wi-Fi Alliance supports this approach. As the Commission notes, a newly expanded group of wireless microphone users are now eligible for Part 74 licenses. If a user of a large number of microphones requires protection, it can and should apply for licensed protection. Thus, the Commission's rules providing registration options for large users make this rule unnecessary. In this way, unlicensed wireless microphone users will be put on the same footing as other protected operations in the 600 MHz band.<sup>176/</sup>

## V. CONCLUSION

The Commission has a great opportunity in this proceeding to develop technical rules which will support the growth of innovative unlicensed devices in the 600 MHz band. In order to foster the most beneficial use of this spectrum, the Commission should expand the channels available for white space devices (both fixed and personal/portable); revise its database requirements to focus on providing white space devices with channel validity duration and other permitted technical parameters based on device capabilities, expected range of travel (for personal/portable devices), location accuracy, and other factors, rather than focus on re-check intervals; and eliminate overly protective technical requirements such as the stringent OOB requirements on channels 36-38. With these changes, the Commission will best promote the use of white space operations without causing harmful interference to incumbent operations or future licensed wireless services.

---

<sup>174/</sup> *Id.* ¶ 186; see also generally *TV Bands Wireless Microphones Second Report and Order*.

<sup>175/</sup> NPRM ¶ 186.

<sup>176/</sup> See *id.* ¶ 187.

Russell H. Fox  
Kara D. Romagnino

MINTZ, LEVIN, COHN, FERRIS, GLOVSKY  
AND POPEO, PC  
701 Pennsylvania Ave., NW  
Suite 900  
Washington, DC 20004  
(202) 434-7300

*Counsel for Wi-Fi Alliance*

February 4, 2015

Respectfully submitted,



Edgar Figueroa  
President and CEO

WI-FI ALLIANCE  
10900-B Stonelake Blvd.  
Suite 126  
Austin, TX 78759  
(512) 498-9434  
[efigueroa@wi-fi.org](mailto:efigueroa@wi-fi.org)